Consumers' willingness to pay for safer fish: preliminary results from a survey about mercury contaminated fish in Friuli Venezia Giulia Region

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Abstract

This study investigates the impact on consumers' fish choice of a labelling system providing information about mercury-free fish. Taking a sample of costumers from Friuli Venezia Giulia Region (Italy), we applied a choice experiment to estimate consumers' willingness to pay (WTP) for mercury-free labelling and to test whether this WTP differs from WTP for local origin fish. The chosen fish was Seabass given that it is well known and frequently consumed in Italy as it is a local product of the Northern Adriatic from both fishing and farming. Our results highlight how respondents are more likely to consume and willing to pay for local (farmed or fished) fish than to pay a premium price for fish with a "mercury-free" label.

Keywords
Fish, consumers' preferences, mercury, willingness to pay, economic activity.

Introduction

Different food scares have taken place in Europe having different origins (WHO, 2011) in last thirty years. One example is mercury (Hg) poisoning in fish. Although the recurring nature of the different food crises made food safety an issue of increasing public concern (Knowles et al., 2007), the socioeconomic aspects of reducing or stopping a contaminant based economic activity could be of more concern to residents than food poisoning (Maurice-Bourgoin et al., 1999). This seems to be the case of S. Giorgio di Nogaro, Torviscosa, and Cervignano del Friuli municipalities, in the South part of Friuli Venezia Giulia Region, an area bordering the Northern Adriatic Sea, where a cellulose production company started its activity in the '50s. The company was, especially in the past, a significant source of income and occupation for local residents, but because of using chlorine-soda amalgam it created a relevant contamination of mercury, that is an environmental and safety problem of increasing concern nowadays. A number of studies reported that adverse health effects of mercury have been documented at relatively low exposure levels (Oken et al., 2003; Renzoni et al., 1998). Moreover, long-term and frequent intake of seafood with high mercury levels by

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populations living in coastal fishing villages is associated with a toxic risk (Renzoni et al., 1998; Wolkin et al., 2012).

According to Horvat et al. (2014), the Gulf of Trieste is one of the most mercury-polluted areas in the Mediterranean and worldwide due to past mining activity in Idrija (West Slovenia), but also the remaining part of the Northern Adriatic suffers because of different anthropogenic pressures. For example, it was estimated that from the years 1949 to 1984, nearly 186,000 kilos of mercury had been released into the environment by cellulose production in the area of Torviscosa, mainly in local rivers and lagoon, where mercury pollution due to sediments is 11.5 g/m^2. Because of i) this high concentration, ii) risk for neuro-developmental toxicity due to exposure to mercury, and iii) the presence of fish farming, the area was considered with a high level of danger and has been included in a recovery and restoration national program in favor of polluted sites (Ministerial Decree 18th September 2001, n. 468).

Several previous studies analysed the impact of human activity in Northern Adriatic and demonstrated that mercury is bio-accumulative and highly toxic (for example, Faganeli et al., 2003; Horvat et al., 2014; Rajar et al., 2000).

Despite the risks due to toxicological considerations (mercury presence) (Kobal et al., 2004 and 2008), an intense international debate about whether or not the benefits of eating fish outweigh the risks has emerged. In fact, fish consumption involves a complex balance between nutritional benefits (Omega-3s) and risks (Frewer et al., 2005; Marette et al., 2008a and 2008b). Consequently, there is the need on the one hand to recommend to limit high-mercury fish, and on the other hand to encourage fish consumption (Hughner et al., 2009).

Caswell and Hooker (1996) stated that safety can be treated as a dimension of food quality, where safety attributes also include the presence of heavy metals. Fish safety is thus a "credence" quality attribute: the consumer can never ascertain by himself the presence of such attribute, having to rely on the information given. Because of this credence aspect, certifications and the use of a clear, concise and consistent labelling system on fish products may be used to provide information to consumers.

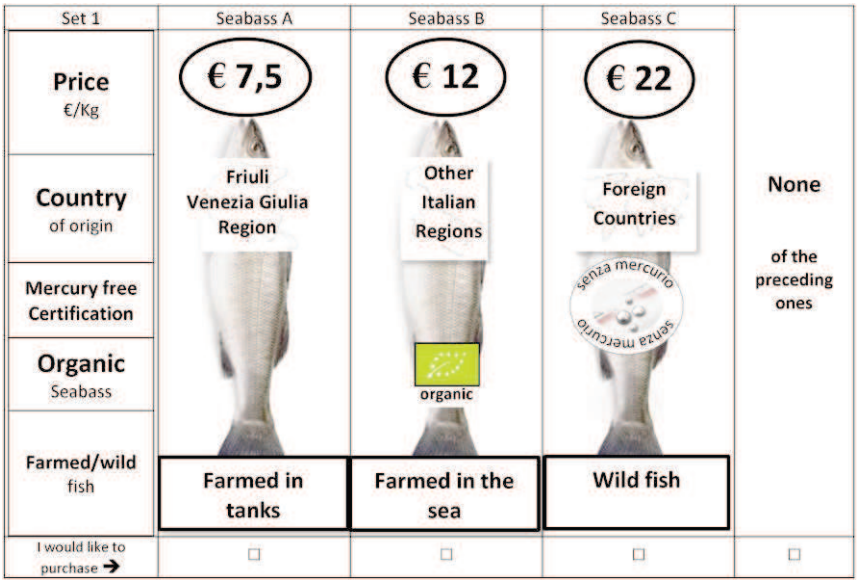
The purpose of this paper is to evaluate fish consumption behaviour in the above-mentioned Friulan area and to determine the impact on consumers' choice of fish of a labelling system providing information about mercury-free fish.

The study was based on a choice experiment analysed using a random parameter logit model. A specific objective was to estimate consumers' willingness to pay (WTP) for mercury-free labelling and to test whether this WTP differs from WTP for local origin fish. To our knowledge, detailed empirical research on consumers' behavior differentiation between mercury-free labelling and conventional fish is lacking. While there are a number of studies that admitted fish consumers face a series of choices regarding whether to eat fish they catch or commercial fish, which species to eat, what trophic level or size of fish to eat, how much fish to eat, and provided information about the risks (Marette et al., 2008b; Roosen et al., 2007) or levels of contaminants in the fish that are commercially available (Burger et al., 2005), none of these studies assessed the importance of providing information to consumers about fish safety using mercury-free labelling and to analyse its impact on consumers' purchasing behavior and WTP.

Materials and Methods

To elicit consumers' preferences and evaluate perception of mercury risk in fish, a choice experiment (CE) was conducted from October to December 2014 relying on a face-to-face based survey.
The chosen fish was Seabass given that it is well known and frequently consumed in Italy as it is a local product of the Northern Adriatic from both fishing and farming.
The survey was conducted in the municipality of Torviscosa and in the bordering municipalities.
We conducted a preliminary pilot survey that was delivered to 50 respondents. This pre-test resulted in a number of minor changes in the formulation of questions.
The final questionnaire used for the data collection consists of three parts. The first includes socioeconomic questions. The second part investigates respondents' habits regarding fish consumption while the third part is devoted to the CE.
Looking at the questionnaire section focusing on the CE, first the CE was introduced, and the attributes with the corresponding levels were presented. Second, information about risk and benefits of fish consumption were provided. According to Marette et al. (2008a) we restricted our attention to one benefit, namely, Omega-3 fatty acids, and one risk, namely, mercury, before each respondent was faced with the choice sets. In detail, we provided these information: i) brief explanation about the health benefit coming from Omega-3 fatty acids and recommendation regarding the weekly consumption of fish, and ii) concise explanation about the health risk coming from mercury and recommendation for avoiding predatory fishes consumption.
A CE involves presenting a series of hypothetical scenarios to participants who are asked to choose their preferred option from a set of mutually exclusive alternatives. Respondents were asked to choose six times and therefore were presented six choice tasks. Each task contained three choice alternatives and included a 'No choice' alternative (Fig. 1).

Figure 1 – Example of choice set



Source: own elaboration

We selected five attributes for our choice experiment. The first attribute was the price of the seabass (€/kilo). The price levels used in the choice tasks were selected looking at the prices at the marketplace at the time of the study. Data from the Italian Institution for Agro-Food Market Services (ISMEA) indicates that the average price of a kilo of seabass from January 2014 to September 2014 was about € 7.50. We considered this mean price as the lower-end of our price range, given that we were interested in the premium consumers were willing to pay to avoid mercury contaminated fish. Therefore we had to consider prices above the average. The price attribute had 3 levels: 7.50 €/Kg, 12 €/Kg and 22 €/Kg.
Each choice task contained four additional attributes (Table 1). The attributes and their levels were decided during preliminary focus group discussions.

Table 1 - Attributes and their corresponding levels

Attribute	*Levels*
Geographic origin	Friuli Venezia Giulia Region; other Italian Regions; other countries
Mercury-free certification	Yes; no
Organic	Yes; no
Farmed/wild fish	Farmed in tanks; farmed in sea; wild fish
Price (€/kg)	7.5; 12; 22

Source: own elaboration

The "country of origin" attribute had three levels: fished or farmed seabass in Friuli Venezia Giulia, in other Italian Regions; and in other countries.
The (fake) mercury-free and organic certification attributes were indicated as present or absent. As regards farmed or fished seabass, three different methods were considered for this survey: farmed in tanks; farmed in sea; and wild fish.
Other potential attributes, such as the fish's size, were considered but eventually omitted from the final design in order to restrict the complexity of the choice tasks.
The respondents were informed that the seabasses presented in each choice task had no other difference between each other apart from the listed attributes.

Results

The survey was administered to 200 individuals and resulted in a total of 181 usable questionnaires.
Face-to-face interviews were conducted by the same interviewer and respondents completed the survey with his assistance.
A synthesis of the main socioeconomic characteristics of respondents is presented in Table 2. 91% of respondents usually consume fish, and 65% consume shellfish. Those that do not consume fish (9%) provided the following motivations: 53% for particular personal tastes, 37% because of high price or intolerance, and 5% due to pollution (5% did not respond). Those that do not consume shellfish motivated their choice as follows: 60% for particular

personal tastes, 21% because of high price or intolerance, and 6% due to pollution (13% did not respond).

Table 2 – Descriptive characteristics of participants in the CE

		%
Gender	Male	45
Age	Less than 25 years	29
	25-39	20
	40-59	34
	60-79	15
	More than 80	2
Family members	1-2	33
	3-4	59
	5 and more	8
Occupation	Entrepreneur	5
	Students or housewives	33
	Employee	43
	Self-employed	8
	Retired	11

Source: own elaboration

CE data were analysed using NLogit4® software and an RPL model was estimated (Table 3). The utility function considered is the following:

$$U(x_i) = \beta_0 \cdot OPT\text{-}OUT + \beta_1 \cdot FVG_i + \beta_2 \cdot ITALY_i + \beta_3 \cdot NOMERCUR_i + \beta_4 \cdot SEAFARM_i + \beta_5 \cdot WILD_i + \beta_6 \cdot ORGANIC_i + \beta_{price} \cdot PRICE_i$$

where: OPT-OUT = dummy for the "none of these / no choice" option; FVG = dummy for origin from Friuli Venezia Giulia; ITALY = dummy for origin from the remaining Italian Regions; NOMERCUR = dummy for mercury-free certification attribute; SEAFARM = dummy for farmed fish in sea; WILD = dummy variable for wild fish; ORGANIC = dummy variable for organic fish; PRICE = price in €/kilo. The β_s coefficients can be considered as the marginal utilities of each attribute of the utility function.
After estimating different models, the following variables resulted to have some heterogeneity and were considered as normally distributed random parameters: FVG, ITALY, NOMERCUR, SEAFRM and WILD.
The RPL model has a reasonably good fit (McFadden Pseudo R-squared = 0.26) (Table 3).
All the coefficients but organic are statistically significant ($p<0.05$), indicating that the organic attribute was not important in determining fish purchase intentions among respondents. As expected, the price coefficient is negative.
Respondents were willing to pay 11.8 €/kg for mercury-free certified fish. Surprisingly but in line with other descriptive results, respondents were willing to pay more for local fish than for safer fish: 20.3 €/kg if the origin of fish was Friuli Venezia Giulia Region, and 10.2 €/kg for fish for other Italian Regions. A significant WTP was found for wild fish (11.1 €/kg).

Table 3 – RPL model results

Variable	Standard Coefficient	Prob. Error	b/St.Er	p-value	WTP (€)		
Random parameters					Average	95% Confidence interval	
						Lower	Upper
FVG|	2.116	0.244	8.68	0.000	20.3	5.32	35.19
ITALY|	1.070	0.295	3.62	0.000	10.2	0.92	19.57
NOMERCUR|	1.232	0.252	4.90	0.000	11.8	2.90	20.69
SEAFRM|	0.600	0.261	2.29	0.022	5.7	-1.01	12.49
WILD	1.157	0.207	5.59	0.000	11.1	5.32	35.19
Non-random parameters							
OPT-OUT	0.418	0.255	1.64	0.102			
PRICE	-0.104	0.012	-8.49	0.000			
ORGANIC	0.225	0.246	0.91	0.361	2.2	0.74	3.56
Distns. of RPs. Std.Devs or limits of triangular							
NsFVG	1.193	0.156	7.62	0.000			
NsITALY	1.132	0.203	5.57	0.000			
NsNOMERC	1.931	0.208	9.29	0.000			
NsSEAFARM	0.962	0.206	4.67	0.000			
NsWILD	0.770	0.171	4.51	0.000			

McFadden Pseudo R-squared: 0.26 Loglikelihood = -1119.23 N.Observations: 1806

Source: own elaboration

Conclusions

The aim of this study was to investigate the fish consumption behaviour in the Torviscosa area of Friuli Venezia Giulia with reference to five attributes: origin (Friuli Venezia Giulia, other Italian Regions, or other countries), mercury-free certification, organic certification, farming or fishing method (farmed in tanks, farmed in sea, wild fish), and price. We tried to quantify the WTP for these attributes. One specific and original aspect of our study was to look at the influence on consumers' purchase behaviour of the information provided through a mercury-free labelling system.

Our findings revealed a strong and positive preference for locally farmed, or fished fish, also if local lagoon in the Northern Adriatic is one of the most mercury-polluted areas in the Mediterranean (Horvat et al., 2014). In fact, the country of origin had a strong effect on the interviewees' utility. This result also emerged in other recent researches, where respondents tended to prefer local food (Asche et al., 2012; Claret et al., 2012; Mauracher et al., 2013; Troiano et al., 2014; Vanhonacker et al., 2011).

Results point out the limitations of a labelling strategy to influence the behaviour of respondents. In fact, they highlight how respondents are more likely to consume and willing to pay for local (farmed or fished) fish than to pay a premium price for fish with a "mercury-free" label. This might be due to fear of residents about compromising an economic activity, which has been increasing local revenues and occupation. If the latter assumption holds

true, the socioeconomic aspects of reducing or stopping a contaminant based economic activity are of more concern to residents than food poisoning (Maurice-Bourgoin et al., 1999) at the time of the data collection.
These results are relative to the specific case study, fish considered and panel interviewed. It is therefore recommended to further investigate fish consumer preferences for "mercury-free" labelled seafood in different geographical contexts. We think that it is really important to make people aware of the quality of the food they eat, especially when food is at risk of contamination. With respect to our results future applications should try to replicate our study and if similar results are obtained try to understand why people neglect food safety in favour of other aspects. To better understand the determinants of respondents preferences future studies should also consider their demographic and socioeconomic characteristics in modelling consumer choices. In addition, the application of the latent class model could be useful to highlight the presence of heterogeneity among different groups of respondents (Tempesta and Vecchiato, 2013).

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